

## APPENDIX A

### CALCULATION OF SCREENING LEVELS FOR ASBESTOS FIBERS IN AIR TASK-BASED MONITORING ACTIVITIES

#### 1.0 Basic Equations

Risk from inhalation exposure to asbestos fibers may be calculated using two alternative risk models (IRIS, Berman and Crump 2003). In either case, the basic equation is

$$\text{Risk} = C * \text{UR} * \text{TWF}$$

Where:

C = Concentration of fibers in air (f/ml)

UR = Unit Risk (risk per f/ml)

TWF = time-weighting factor (fraction of lifetime during which exposure occurs)

The target screening level can be calculated by revising the equation as follows:

$$\text{SL} = \text{TR} / (\text{UR} * \text{TWF})$$

Where:

TR = Target cancer risk level

#### 2.0 Calculation of Screening Levels

Each of the three input parameters needed to calculate the target Screening Level is discussed below, along with the resulting values.

##### Target Risk Level

The target risk level is a risk management judgment, and may depend on a number of factors. For the purposes of these calculations, the Target Risk was assumed to be 1E-04 (i.e., one in ten thousand).

##### Unit Risk

As noted above, there are two alternative methods for estimating cancer risk from asbestos, and hence there are 2 alternative values for UR:

IRIS (2003) identifies a unit risk of 0.23 per PCM fiber per ml

Berman and Crump (2003) identify a unit risk of 0.098 per TEM protocol structures per ml, assuming that 50% of the protocol structures are longer than 10 microns in length. This value is the average across males and females, smokers and non-smokers and also is based on exposures to chrysotile asbestos – the majority of structures identified at the site are chrysotile. (Probably should figure in some small percentage of exposure to amosite)

### Time-Weighting Factor

The TWF is the fraction of full time that exposure occurs. This depends on the assumed time, frequency, and duration of exposure. For the purposes of these calculations, the following assumptions were used:

Activity	Exposure Time (hr/day)	Exposure Frequency (d/yr)	Exposure Duration (years)	Total hours	TWF
Total	24	365	70	613200	1.00
Playing in the Dirt	2	270	10	5400	0.0088
Walking	2	270	30	16200	0.026
ATV Use	2.5	270	30	20250	0.033
Gardening	10	50	30	15000	0.024

Note that these assumptions may not be identical to those that are used in the actual risk calculations. Rather, these were selected to represent a conservative estimate of the actual exposure associated with each scenario

Briefly, the values selected for these scenarios were based on the following references:

*Playing in the Dirt:* Exposure Factors Handbook, Table 15-58, the 90<sup>th</sup> percentile value of 120 minutes/d for children ages 1-11 was used for the exposure time. Best professional judgment about snow cover at the site was used to arrive at 270 days/year and the entire span of the age group was used for exposure duration.

*Walking:* Exposure Factors Handbook, Table 15-126, the 95<sup>th</sup> percentile value of 95 minutes/d was rounded up to 2 hours/d for adults. Best professional judgment about snow cover at the site was used to arrive at 270 days/year and the entire span of the age group was used for exposure duration.

*ATV Use:* Exposure Factors Handbook (assuming bicycling is a conservative surrogate), Table 15-127, the 95<sup>th</sup> percentile value of 151 minutes/d was rounded to 2.5 hours/d for adults. Best professional judgment about snow cover at the site was used to arrive at 270 days/year and the entire span of the age group was used for exposure duration.

*Gardening:* This scenario is based on the 95<sup>th</sup> percentile value for hours per month that adults garden as provided in the Exposure Factors Handbook, Table 15-62, combined with the standard EPA residential exposure duration.

### Results

Based on these inputs, the target screening levels are as follows:

Activity	Screening Level	
	IRIS (PCM fibers/ml)	Berman and Crump (protocol fibers/ml)
Playing in the Dirt	0.05	0.1
Walking	0.017	0.04
ATV Use	0.013	0.03
Gardening	0.02	0.04

For the above, I assumed a Berman and Crump unit risk of 0.098 based on the assumption that 50% of the fibers are long and all are chrysotile. We could use site-specific data about the proportion of chrysotile versus amphibole (90% in air data, x% in soil) to come up with a revised estimate.

## ***For Informational Purposes***

### ***Region 9 Approach to Calculation of Screening Levels***

Attachment 1 is a Screening Level Calculation document developed for sites in California where naturally occurring asbestos (NOA) is present. For consistency, this approach was adopted for this site as follows.

Given the most conservative receptor (a female child playing in the dirt), a screening level was calculated using Region 9's approach.

#### ***Child Play and Adolescent Athletic Exposures for 0.01 f/cc clearance level:***

Unit Cancer Risks (UCRs) from "Airborne Asbestos Health Assessment Update" (EPA/600/8-84/003F, 1986) for a 10 year exposure to 0.01 f/cc for a single age category (these risk values apply to continuous [24 hours per day, 365 days per year] exposures):

Ages 0 - 10 years old:

Female, non-smoker - mesothelioma:	122.8x10 <sup>-5</sup>
Female, non-smoker - lung cancer:	2.7x10 <sup>-5</sup>
Total - female, non-smoker:	125.5x10 <sup>-5</sup> (1.26x10 <sup>-3</sup> )
Male, non-smoker - mesothelioma:	102.3x10 <sup>-5</sup>
Male, non-smoker - lung cancer:	2.9x10 <sup>-5</sup>
Total - male, non-smoker:	105.2x10 <sup>-5</sup> (1.05x10 <sup>-3</sup> )

*Potential excess cancer risk for a child playing in the dirt 2 hours per day, 9 months per year for 10 years between ages 1 and 11 years old:*

The potential excess cancer risks due to exposure at the playground (based on RME exposure assumptions of 12 hours per week [2 hours per day, 6 days per week] during the 9 month 'dry season') are then calculated as:

$$\begin{aligned}\text{Females: } & 125.5 \times 10^{-5} \times (2 \text{ hours} / 24 \text{ hours}) \times (270 \text{ days} / 365 \text{ days}) = \mathbf{7.7 \times 10^{-5}} \\ \text{Males: } & 105.2 \times 10^{-5} \times (2 \text{ hours} / 24 \text{ hours}) \times (270 \text{ days} / 365 \text{ days}) = 6.5 \times 10^{-5}\end{aligned}$$

This analysis indicates that if the lifetables from EPA 1986 are used as the basis for calculating screening levels, a more conservative cleanup level (0.01 f/cc as compared with 0.05 f/cc) is generated. This is consistent with the theory that asbestos exposures to children may result in higher levels of disease than corresponding exposures in adults.

The other scenarios above were not recalculated since only the playing in the dirt scenario is applicable to children.